Profiting from innovation

What are the underlying drivers of profiting from innovation? The biggest factor appears to be having a good stream of high-quality graduates working for a company.

By Bob Gauldie and William Giesbers

WHEN IT COMES to the commercial world, innovation is simply shorthand for profiting from innovation. New Zealand companies, in order to make more money, continually readjust their products to accommodate innovative technologies (mostly science based) that change the marketability of their products. From an engineering or product development perspective, any investment strategy for profiting from innovation starts with the question: where do companies source the innovative technologies that will boost profitability?

If we think of the big, fundamental innovations such as the computer, the TV, the artificial heart and so on, then the sources are mostly universities and government-funded research laboratories. This is because these big-picture innovations come with a huge cost drawback that effectively keeps them out of the hands of most companies — the time of development can be many years involving very high costs. (The table 'Duration of the innovative process' shows some typical development times.) Though the data in the table is somewhat old, more recent work has shown the 19.2-year average in the table has extended to 30 years for most fundamental science-based innovations, and shortened to ten years for most IT-related innovations. Very few companies, especially in a small market like New Zealand, can afford such long investment cycles, or the huge upfront costs of marketing products to recover a profit from their investment. Big, fundamental science innovations are clearly the preserve of government-funded laboratories and universities as well as a few giant global companies.

Most company-level innovation operates over much shorter investment and implementation cycles. Typically companies have a three- to five-year period from implementation running through peak production, to the phase-down cycle. But where do such implemented innovations actually come from? There were some surprising results from a 2001 survey of innovation in UK manufacturing industries. Overwhelmingly, the short-term innovations that companies implement in their product lines either come from inhouse research or are bought as commercial IP from other companies. Very little — much less that 10% — comes from universities and government-funded research laboratories. A similar picture emerges from the EU where research has shown, on average, publicly funded research institutions contribute 7.4% of knowledge inputs into commercial products. UK institutions are much better at documenting the history of the economics of implementing science-based technological innovation than either the US or the EU. But even the rather general non-quantitative reports from the US National Science Foundation confirm that universities and

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government-funded research laboratories are not the major direct sources of science-based innovative technologies that companies typically implement in their product development.

But another surprising picture emerges if we ask, what enables companies to profitably implement innovative technologies in their product lines, regardless of their source? EU data correlating innovation indicators and 2000 GDP per capita shows the most important factor over the short term (two-year lag) in profiting from innovation is having high-quality graduates working for the company who can cope with the technical demands of the implementation process. Over the three- to five-year time lags, the most important factor is business expenditure on R&D, not public research institution funding, although over longer time scales publicly funded R&D assumes greater importance.

So that's the broad-brush picture of the mechanics of the overall process of profiting from innovation. Firstly, the big, fundamental science innovations are huge

Duration of the innovative process

Innovation	Year of first conception	Year of first realisation	Duration(years)
Heart pacemaker	1928	1960	32
Hybrid corn	1908	1933	25
Hybrid small grains	1937	1956	19
Green revolution, wheat	1950	1966	16
Electrophotography	1937	1959	22
Input-output economic analysis	1936	1964	28
Organophosphorus insecticide	1934	1947	13
Oral contraceptive	1951	1960	9
Magnetic ferrites	1933	1955	22
Video tape recorder	1950	1956	6
AVERAGE DURATION			19.2

SOURCE: SCIENCE, TECHNOLOGY, AND INNOVATION. PREPARED FOR NSF BY BATTELLE COLUMBUS LABORATORIES (COLUMBUS, OHIO), NSF-C 667, FEBRUARY 1973, P. 9.

in cost and take a long time to reach fruition as profitable commercial products. They do, however, also provide the essential energy that technology-based economies must have to survive over the long term. The big, fundamental science innovations can only be the preserve of the universities and government-funded research laboratories because few companies, probably none in New Zealand except Fonterra, can afford such long investment cycles.

Secondly, while the universities and government-funded laboratories are pounding away at the cutting edge of science, they are also producing high-quality graduates. The pressure-cooker environments of the theoretical science research laboratories in our best universities and government-funded laboratories may not produce a steady stream of Nobel Prizes, but they do produce a steady supply of high-quality graduates who walk out with the best of the new thinking, and the quantitative tools needed for such thinking, in their newly capped heads. And it is this supply of high-quality graduates that determines whether or not companies can implement newly available innovative technologies to increase their profits.

Thirdly, the short-term, product-oriented technological innovations that are the mainstay of competitive marketing are for the most part either created inhouse as business expenditure on R&D, or sourced from other companies.

Against this background, you might expect a New Zealand national strategy for profiting from innovation would focus on a two-pronged approach. One prong being high-stakes fundamental research at universities and government-funded laboratories not only as a long-odds bet on the future, but also as an odds-on essential source of supply of quality graduates. The other prong being some mechanism — tax amelioration or grant money — to facilitate business expenditure on inhouse technology development to be used to develop within companies the short-term innovations needed for up-marketing existing product lines, or to sell on to other companies.

*Next month Gauldie and Giesbers comment on how New Zealand's strategy fits into this general innovation picture, including examining the New Economy Research Fund report from the Ministry of Research Science and Technology.

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The top 5

Sources of information for innovation in UK manufacturing industries, 2001

Within the enterprise	26.1%
Client or customers	15.9%
Suppliers of equipment, materials, components or software	15.6%
Health and safety standards and regulations	12.4%
Technical standards	11.1%

SOURCE: UK INNOVATION SURVEY, 2001, DEPARTMENT OF TRADE AND INDUSTRY.

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